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INSURANCE AND THE U.S. COMMERCIAL SPACE LAUNCH INDUSTRY

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(II)

LETTER OF TRANSMITTAL

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC, June 20, 1988.

DEAR COLLEAGUE: The Committee on Commerce, Science, and Transportation and the Subcommittee on Science, Technology, and Space are pleased to submit this report, the second one requested by the Committee, on insurance and the commercialization of space.

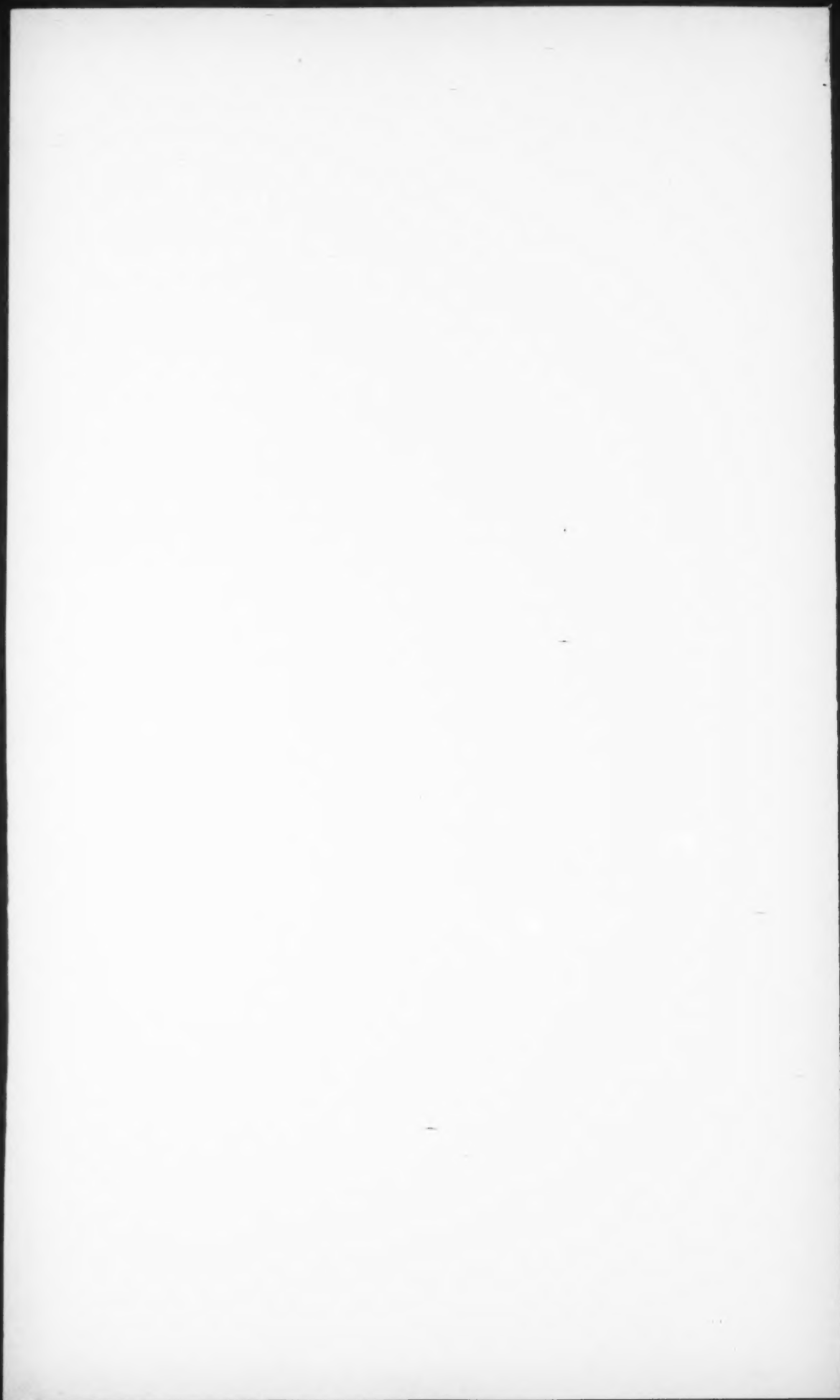
We hope this report furthers public knowledge on the issue of insurance and space commercialization, especially as regards expendable launch vehicles, and that it highlights the major issues involved in the current debate over H.R. 3765 and S. 2395, the Commercial Space Launch Act Amendments of 1988.

While this report has been neither approved, disapproved, or considered by the Committee, I believe that it will benefit all of our Members and their staff.

Sincerely,

ERNEST F. HOLLINGS, *Chairman.*

(III)



LETTER OF SUBMITTAL

CONGRESSIONAL RESEARCH SERVICE,
THE LIBRARY OF CONGRESS,
Washington, DC, June 20, 1988.

Hon. ERNEST HOLLINGS,
*Chairman, Committee on Commerce, Science, and Transportation U.S.
Senate Washington, DC*

DEAR MR. CHAIRMAN: In response to your request to update our 1985 report "Insurance and the Commercialization of Space," we are submitting the enclosed report, "Insurance and the U.S. Commercial Space Launch Industry." The study was conducted by Patricia E. Humphlett, Analyst in Aerospace and Telecommunications, in our Science Policy Research Division and David Whiteman, Analyst in Industry Economics, of our Economic Division. Patricia Humphlett was the primary author of the report and coordinated the project. David Whiteman provided expertise on the structure and operations of the insurance industry and contributed the section of the report on the insurance industry. In accordance with your instructions, we have not repeated material from the 1985 report (prepared by Mr. Whiteman, Jane Gravelle, and Marcia Smith), instead focussing on what changed since that time.

We appreciate the opportunity to assist your Committee, and we hope that the study will meet your needs as well as those of other committees and Members of Congress.

Sincerely,

JOSEPH E. ROSS, *Director.*

(v)

CONTENTS

	Page
Introduction	1
Evolution of the U.S Commercial Launch Services Industry	2
Background on the Property-Casualty Industry Market	3
The Space Insurance Industry	5
Definition of Space Insurance Terms	5
General Description of Space Insurance	6
Law of Large Numbers/Spread of Risk	7
Launch Insurance: Past and Present	8
Third Party Liability	10
NASA Launches	10
Commercial Launches	11
Availability of Third Party Insurance	12
Government Responsibility in An Accident	12
Joint and Several Liability	13
Damage to Government Property	13
Cross Waivers of Liability Between Commercial Launch Participants	14
Competitiveness with Foreign Launchers	14
Arianespace	15
Soviet Union	14
China	15
Japan	16
Options	16
Let the Market Operate Freely	17
Federal Government Liability Limits and Indemnification of Excess Third Party Liability	18
Risk Pooling Third Party Liability	18
Tiered Insurance and Government Insurance	19
Conclusion	20
Endnotes	21

INSURANCE AND THE U.S. COMMERCIAL SPACE LAUNCH INDUSTRY

INTRODUCTION

A commercial space launch services industry is developing in the United States with the support of the Administration and Congress. Previously, the Federal Government launched all payloads in the United States, including commercial or foreign payloads. Today, however, private sector companies are now offering launch services primarily for commercial and foreign communications satellites. The commercial launch industry is very new and, although the companies have signed contracts for launches, the first U.S. commercial launch is not projected to take place until 1989. This new industry is working with the Federal Government to resolve outstanding issues, including insurance, which they believe threaten the development of a viable and competitive commercial launch industry.

When the National Aeronautics and Space Administration (NASA) was providing launches for commercial satellites, insurance was also an issue, but the debate focused primarily on property insurance which covered the proper placement of an operational satellite in orbit.¹ The private launch services industry, however, is most concerned about third party liability insurance, which covers damages to outside property or persons resulting from a launch.

Some industry representatives claim that unless the Federal Government agrees to become more directly involved in resolving insurance issues, including limiting the industry's potential liability, the launch services industry will not develop. There currently is legislation before Congress, H.R. 4399 and S. 2395,² which would limit the commercial launch company's liability for third party losses (with Government indemnification above the limit) and for damages to Government property. However, the Administration and other observers say that such legislation is not necessary and Government involvement in this insurance liability issue could be an undesirable precedent for other sectors of the insurance industry. The advantages and disadvantages of possible actions are discussed in the final section of this paper.

Space insurance is unique from other kinds of insurance and is offered only by a limited number of companies. Regardless of whether the debate focuses on insuring the value of a satellite to be placed in orbit or third party liability, several elements remain constant.

(1)

Footnotes appear at end of report on page 21.

First, the number of launches on which to base insurance underwriting evaluations is and will remain small in comparison to many other insured events and each loss consequently has a much larger impact. Second, there is a constant need for better technical information on which to estimate risk, in part, because launch vehicle technology changes gradually over time. And finally, the space insurance market is very volatile, based on the insurance industry's confidence or lack of confidence in the reliability of launch technology. In addition, the space insurance market is influenced by the cyclical volatility that characterizes the normal operation of insurance markets in the United States. These characteristics will determine the options open to the Federal Government and Congress in its consideration of insurance issues for commercial launch companies.

EVOLUTION OF THE U.S. COMMERCIAL LAUNCH SERVICES INDUSTRY

A nascent domestic commercial launch services industry has begun to form over the past few years. The 1984 Commercial Space Launch Act and President Reagan's August 1986 decision to take commercial and foreign payloads off of the shuttle³ have helped to create the industry as it now exists.

When President Nixon approved the shuttle program in 1972, he announced that it would be the Nation's primary launch vehicle and that expendable launch vehicles (ELVs), with the exception of the smallest ELV (Scout), would be gradually phased out. In the early to mid-1980s, NASA launched foreign and commercial payloads into orbit using primarily the shuttle (and also ELVs, which were to be gradually phased out).

The Reagan administration first issued a statement of support for a commercial launch services industry in a National Security Decision Directive issued in 1983, but took no further action. In 1984, Reagan issued an Executive order designating the Department of Transportation (DOT) as the lead agency to supervise this activity. Congress also supported the commercialization of launch services by passing the 1984 Commercial Space Launch Act (P.L. 98-575). The act created DOT's Office of Commercial Space Transportation and gave it authority to promote and regulate the industry. As part of that responsibility, DOT is establishing liability insurance requirements which the companies must meet in order to obtain a launch license.

Despite support from the Executive Branch and from Congress, the commercial launch services industry was slow to develop. In the summer following the January 1986 space shuttle Challenger accident, President Reagan released National Security Decision Directive 254 which stated that commercial and foreign payloads no longer would be launched by the shuttle. As a result of this decision, companies and foreign countries whose satellites could no longer be launched from the shuttle began to consider buying commercial launch services from U.S. companies. They also bought launches overseas, primarily from the French company Arianespace. (Foreign launch competition is discussed below.)

The U.S. commercial launch industry currently consists of three major companies and several smaller companies. Each of the companies, both large and small, plan to produce the launch vehicles and market launch services to commercial U.S. and foreign customers. The three big companies, Martin Marietta, McDonnell Douglas, and General Dynamics, are primarily targeting commercial communications satellites for launch services. The smaller launch companies are marketing launch vehicles with lesser capability, and thus have a different market focus. These companies include: Space Services Inc., Conatec, E Prime, and American Rocket.

Martin Marietta, McDonnell Douglas, and General Dynamics have been producing ELVs under contract for the Government since the 1960s. The Air Force has a contract with each to build launch vehicles: Martin Marietta for Titans, McDonnell Douglas for Deltas, and General Dynamics for Atlases. These Air Force contracts are very important to the commercial launch companies because they have facilitated the re-opening of production lines (that were to have been closed under the pre-Challenger policy) and will lower unit prices for commercial customers. Similarly, the Air Force hopes that its contract costs will be lowered by the production of additional vehicles for commercial launches.

Government involvement in the launch industry extends beyond Air Force contracts. NASA is planning to buy launch vehicles and, when they are available, launch services from the private sector. The launch company will lease Department of Defense (DOD) or NASA launch facilities and related services for each commercial launch, including range safety services. The Government now will provide resources and services available to the private sector on a direct cost basis. In addition, DOD will provide some specialized components and in-plant Government quality control services in order to guarantee that commercial-launch vehicles have the same level of reliability as those built under Government contract. DOD will provide this service on a cost reimbursement basis to the three major ELV companies. Increased Government involvement should help restore the insurance industry's confidence in the reliability of U.S. launch technology. It also raises the vexing question of whether this level of Government involvement makes the Government partially responsible, and therefore liable to some degree, for a catastrophic accident (which is discussed below).

BACKGROUND ON THE PROPERTY-CASUALTY INDUSTRY MARKET⁴

The insurance industry is generally perceived as being comprised of three sectors: life, health, and property-casualty (liability). All insurance coverage relating to commercial launch services are forms of property-casualty insurance.

The property-casualty sector of the insurance business in the United States has in the post World War II era alternated between "soft" and "hard" (or "tight") insurance markets. The cyclicity has been a recurrent feature of the U.S. property-casualty market in the United States, while other countries' insurance market cycles are much less severe.

These market fluctuations have come to be referred to in insurance circles as the "underwriting cycle."

When rates are adequate, risk selection careful, and the industry is generally performing well (profitably), new capital is attracted and begins to enter the marketplace. When interest rates are high, as they were in the early 1980s, insurers can reap substantial investment income. High interest rates also attract capital and new competition into the market creating new capacity and keep prices low. New capital can come from a number of sources. "Capacity" can increase when insurers decide that they can commit more of their assets to underwriting profitable lines of business. New insurers, such as off-shore captive insurers, foreign insurers, and domestic insurers who generally write other lines of business, begin to enter the market. These new sources of insurance capacity begin to generate increased competition for available premium volume, and price cutting (discounting) begins. Increased competition also means that underwriting standards for risk selection diminish and insurers, in their desire to maintain market shares, begin to take on less-than-standard business also at discounted rates. Looser underwriting practices and inadequate rates, over time, inevitably result in rising claims losses and possible loss of profitability. During the early 1980s, rapidly rising investment income subsidized rapidly rising losses from underwriting activity—losses created by the inadequate rates resulting from intense price competition and surging claims. From the perspective of insurance consumers, the investment subsidy which produced low premiums seemed a fair exchange for the investment value of their premium dollars to insurers.

When competition is too severe and losses too high, the market begins to harden. Capacity shrinks, and some insurers withdraw from the market. The remaining insurers raise prices and tighten underwriting standards. When an insurance market hardens and capacity shrinks, prices rise and selectivity tightens. Problems, sometimes very severe problems, of availability and affordability of necessary insurance coverage results. Insurance markets usually stabilize and eventually profitability returns. With the return of profitability, new capital is attracted. Then the ensuing competition among insurers for a share of the available premium volume eventually leads to another soft market.

Traditionally, the measure of economic health and performance of an insurance operation is the "combined ratio." This ratio relates claim losses and underwriting expenditures to premium income. A combined ratio of 100 means the operation is breakeven, below 100 means an underwriting profit, and above 100 indicates a loss.

The combined ratio does not, however, reflect profits that come from investing premium dollars which help offset underwriting losses. The high interest rates in past years helped insurers to have high investment incomes, and many companies came to rely on this income, rather than on positive underwriting results, for favorable year-end performance. This strategy has been dubbed "cash-flow underwriting," and the concept has been criticized by some financial experts and State regulators. Falling interest rates force insurers to increase premium rates and to be more selective in their underwriting.

The liability insurance industry went through what the worst cyclical downturn in the industry's history in the mid-1980s as evidenced by huge rate increases, mass cancellation of coverage, and entire lines of insurance virtually unavailable at any price. Insurance problems involving very high premium rates and limited amounts of available coverage, in large part, stemmed directly from very substantial losses suffered by insurers. Industry critics have charged that these losses largely resulted from self-destructive insurer management actions involving the long term pricing of risk below cost. Insurers say the losses resulted primarily from claims arising from a liberalized tort law system.⁵

THE SPACE INSURANCE INDUSTRY

DEFINITION OF SPACE INSURANCE TERMS⁶

1. Pre-launch insurance: covers the manufacture and transport of a satellite or payload to the launch site.

2. Launch insurance: covers the successful launch and placement of a satellite in the correct orbital position in space. This insurance coverage includes the operation of the launch vehicle and related components (including the upper stage vehicle) required to deploy the satellite in geostationary orbit. Within launch insurance, satellite owners can choose to purchase insurance to cover the cost of replacing a lost satellite, relaunching the new satellite, and/or recovering lost revenues as a result of the lack of a satellite in orbit. This physical loss-damage insurance coverage has been plagued by a number of launch failures since 1979. Premiums for launch insurance rose from 5 percent in 1979 to 30 percent by 1986 and have remained at about 20 to 25 percent.⁷

3. In-orbit insurance: covers the successful operation of the satellite once it is placed in orbit. Rates for on-orbit insurance have also risen over the past several years, from 1-2 percent to 4-5 percent, and it is not always available.⁸

4. Damage to Government property: covers any damage to Government launch facilities or other property during a commercial launch. Legislation (H.R. 4399 and S. 2395) introduced in Congress would limit a private launch company's liability for damage to Government property. The White House concurs with the idea of limiting the launchers liability for damage, but disagrees on how that limit should be set. As insurance for damage to Government property from space launches has never been provided before, it is unclear what premiums the industry would charge.

5. Cross waiver: During a shuttle launch, in an elaborate cross waiver agreement, NASA and the shuttle users agree to a no-fault inter-party waiver of liability. Each agrees not to sue any other participants for damage caused by another participant on the same shuttle flight. The users also are not liable to the Government for any damage to the shuttle. In addition, should any part of the shuttle malfunction or fail while in flight, payload owners on that flight cannot sue NASA or any of its contractors. Legislation (H.R. 4399 and S. 2395) currently before Congress proposes a similar cross-waiver agreement for private

launches. Cross waivers apply only to launch participants and not to third parties.

6. Third party liability: covers anyone not directly involved in the launch, including damage to outside property or persons resulting from a launch. During its commercial launches on the shuttle, NASA required customers to purchase \$500 million of third party liability insurance, and NASA indemnified (covered the cost of damages) above that level.⁹ In addition, for shuttle launches carrying two or more payloads, NASA arranged for a single, third-party liability contract for \$750 million which all customers shared jointly and paid for proportionately.

During a commercial ELV launch, the launch services company is required to purchase third party liability insurance. All launch participants (contractors, subcontractors, payload owners) will be named insurers under the coverage. The commercial launch services companies are concerned about who would be liable above the level of insurance coverage purchased. The large commercial launch services companies are currently expecting to buy about \$500 million of third party liability insurance. According to some estimates, premiums for \$500 million of third party liability will cost \$500,000, or 0.1 percent of the coverage.¹⁰ Premiums, which used to be 0.02 percent or \$100,000,¹¹ have risen despite the fact that no third party liability claims have ever been paid.

7. Risk pooling: refers to an agreement among members to share the risk of loss or damage. Insurers can form a pool (or an organization) through which they will underwrite a certain type of risk and agree to share premiums, losses, and expenses. Insurance purchasers can also form a pool and contribute an agreed amount of funds with which they would either pay for losses resulting from a failure or accident or buy insurance coverage for the group.

GENERAL DESCRIPTION OF SPACE INSURANCE

Basically, underwriting is about using experience, knowledge, and a certain amount of "feel" or "flair" to assess risk and make appropriate financial judgments. Underlying and crucial to this process is the necessity to have available at all times relevant risk information and data in sufficient quantity and quality to enable its evaluation to facilitate the requisite underwriting decision making.¹²

Space insurance is a specialty line and only a relatively small community within the totality of the insurance industry is actively involved in providing insurance for space launches. In the past, these insurers have made a larger commitment to insuring the actual payload and its safe placement in orbit, called launch insurance, than to other types of space insurance. In addition, the insurance industry has also provided pre-launch insurance, on-orbit insurance, and third party liability insurance, as described in the definitions above. The insurance industry has never before provided insurance to cover possible damages to Government property resulting from a launch, which, according to one insurance executive, will make it difficult to obtain.¹³

In the early 1980s, the space insurance industry suffered a number of serious losses (discussed in more detail below) due to launch failures and the loss of payloads. In addition, the loss of the Challenger, a Titan, a Delta, and an Ariane, all in the first half of 1986, further eroded the insurers' confidence (even though only the Ariane launch was insured). Even before the shuttle accident, experts both in the Government and the insurance industry stated that the insurance industry had seriously underestimated the risk involved and thus had underpriced its premiums.¹⁴ Following these losses, launch insurance premiums increased sharply and capacity decreased drastically. Consequently, the space insurance market virtually collapsed. Even premiums for third party liability increased significantly although no successful claim has been made against this line, further demonstrating how small and how volatile the space insurance market is.

Because a relatively small number of companies provide space insurance, some believe that a loss in one area of space insurance directly influences the ability to cover other risks. Before the Challenger accident, there was disagreement as to the relationship between the different types of space insurance. One insurance industry executive observed that,

All types of space insurance rates have risen regardless of loss ratios. The reason is straightforward. The same players underwrite portions of all different types of policies so that losses all come out of the same small pool.¹⁵

However, a former DOT official saw the industry differently, and DOT still stands by their interpretation:

We share the view of most industry observers that [third party liability premium] increases are primarily the result of the substantial losses that have occurred in the property/casualty insurance industry generally. While one cannot discount at least the psychological effects of losses in one line of space insurance upon other insurance coverage written for the same industry, we believe that any capacity restraints * * * are more the result of these insurance industry-wide liability losses than of the recent losses in space launch insurance lines.¹⁶

The relationship between the different types of space insurance will continue to be important.

LAW OF LARGE NUMBERS/SPREAD OF RISK

Some in the insurance industry have concluded that the space insurance industry requires a much higher number of events (launches), possibly 600 with each different launch vehicle, to accurately measure risk.¹⁷ While other areas of insurance benefit from the law of large numbers, meaning that an event occurs many times (for example, in automobile insurance), increasing one's confidence in being able to estimate the outcome, the space insurance industry is working with much smaller numbers. Large numbers are needed to increase the statistical validity of predictions, but in space launches, there may never be enough events.

For example, the Delta vehicle has launched a total of 182 times since 1960, and only 48 times in the past ten years.¹⁸ In addition, Delta technology has changed and slightly different vehicles have flown over the past 28 years. As one measure of this, the 1960 Delta could lift 200 pounds to low earth orbit and the 1978 Delta could lift 4,000 pounds.¹⁹ The Delta II, currently under development, will be able to lift 11,000 pounds to low earth orbit.²⁰ When Europe developed the Ariane vehicle, they planned to use "mature," proven technology and achieve 90 percent reliability by the 15th flight. Instead, their record to date is 20 successes and 4 failures, or an 83 percent success rate.

The small number of events could be somewhat compensated for if a larger number of insurers were to share the risk, thereby spreading the effect of any losses among many risk bearers. However, the space insurance market is unusually small, and likely to remain so until success and profitability of this specialty line attracts new sources of capital.

Insurance, in its simplest terms, is the losses of the few being shared by the many, and operates according to the law of large numbers. Space insurance does not fit this definition as the losses of the few have been shared by the few also. Space insurance does not enjoy the spread of risk of other lines of insurance. In fact, its spread is dangerously thin. Any one event skews the experience, provoking significant swings in the rates. It is an obvious maxim in this business that the impact of failures on rates far outweighs the effect of successes. There are not enough statistical events, as yet, to work with reliably.²¹

It may not just be the inadequate statistics, but also the over-optimism of the insurance industry when it set its premiums that caused the enormous losses.

[Insurance losses] have also resulted, according to many insurers, from faulty assessments of the risks involved in insuring the launch and operation of commercial satellites. These underwriting misjudgments produced unrealistically low rates from the outset * * *.²²

According to one estimate, if all insurance premiums for launches which occurred through September 1987 had been 14 percent, the insurance industry would have broken even.²³ Instead, premiums have run the extremes, ranging from 5 percent in 1983 to a high of 30 percent in 1985-86. Some insurance executives have questioned their sources of information and the validity of statistics for estimating risk.

LAUNCH INSURANCE: PAST AND PRESENT

Although the first satellite was insured in 1965, the first major loss did not occur until 1977,²⁴ when the European Space Agency (ESA) lost OTS-1, costing the insurance industry \$29 million. In 1979, RCA filed a claim for \$77 million following the loss of its Satcom F-3. The insurance industry paid several claims in 1982, and by late in that year, the combined ratio for satellite launch underwriters was 120 percent, or a 20 percent loss. The Indian Government received about \$70 million when its Insat I-A failed in April 1982. Also that year, an Ariane failure resulted in a \$20 million claim resulting from partial insurance on one of two satellites lost.²⁵

Although 1983 was a successful year for satellite launches, 1984 was not. The underwriters' combined ratio went from 90 percent (meaning a 10 percent profit) at the beginning of 1984 to 180 percent (or an 80 percent loss) by June 1984. During a 1984 shuttle launch, two satellites (Indonesia's Palapa 2-B and Western Union's Westar VI) were not placed into the correct orbits. Although they were later recovered during another shuttle mission and the underwriters reportedly netted about \$30 million for the satellites (after recovery costs), they paid out a total of \$182 million in claims.²⁶ In June, a \$102 million Intelsat V F-9 was lost during an Atlas-Centaur launch. Insurance premiums for a shuttle launch rose from 5-7 percent in 1983 to 15-20 percent of the value of the satellite in June 1984. Several underwriters, including a major London firm, Orion Insurance Company dropped out of the space insurance business.

In 1985, five more satellites suffered launch failures, costing insurers close to \$370 million. The losses included: two Hughes satellites, each insured for \$85 million, and two satellites destroyed during an Ariane launch failure, insured for a total of \$168 million. A leading U.S. underwriter, International Technology Underwriters (Intec), restricted its coverage and no longer would provide on-orbit insurance coverage. The amount of insurance available on the world market dropped to \$60-70 million.²⁷

At this point, the European launch service company Arianespace started providing "relaunch insurance" (but not insurance for the value of the satellite) through a captive company called Space Related Risks Reinsurance Co. (S3R). In 1986, to cover possible launch failures, S3R was charging an 11 percent premium for a second launch on an Ariane vehicle and 13.2 percent for a cash reimbursement for launch costs. (No other aspect of the launch was covered, such as the cost of the satellite.) The initial insurance pool covered 15 satellites, and was fully subscribed. In 1987, Arianespace offered a second pool for fifteen satellites at 12.9 percent for relaunch (later readjusted to 13.5 percent) and 14.5 percent for cash.²⁸ James Barrett, president of Intec, criticized Arianespace's rates because they were far below Ariane's "demonstrated failure rate" which at the time he said was 28 percent. Barrett has advocated establishing a U.S. pool of underwriters for space insurers.²⁹

In January 1986, the space shuttle Challenger exploded during launch killing all seven aboard. Although the shuttle was carrying an uninsured satellite (NASA's TDRSS-2), the loss had a strong impact on the launch industry itself. The United States also suffered launch failures of a Titan and a Delta launch vehicle in April and May respectively. Also in May, an Ariane vehicle failed, destroying a satellite insured for \$82 million, and Arianespace did not resume launches until September 1987. According to one source, after the shuttle and Ariane failures, "satellite underwriters lost total confidence in satellite launches * * *" as the combined ratio reached 148 percent.³⁰ According to Ford Aerospace, the insurance industry's combined ratio for 1977-85 was 200 percent, or, more specifically, the insurers collected \$450 million in premiums and paid out \$900 million in claims. For 1984-85, the loss ratio was 330 per-

cent.³¹ A former insurance executive commented that renewal of on-orbit satellite policies, whose rates had also risen, kept the space insurance industry alive.³²

In January 1987, *Business Insurance* estimated that launch insurance capacity was \$75-100 million per launch. At the end of the year, its estimate was \$120-150 million.³³ However, even while insurance coverage became more difficult to find, a former underwriter commented, "In real terms, there is no capacity crisis. What we have here is a crisis of confidence. There is capacity which exists that has not touched the space industry because it [the space industry] is too volatile and unpredictable." ³⁴

Insurance premiums, which reached a high of 25-30 percent of the value of the satellite, have eased somewhat and are now reportedly at 20-28 percent. Premiums will likely stay high until the insurance companies regain much of their losses. Last year, many underwriters would not write coverage more than 90 days in advance. Currently, the Italian firm Assicurazioni Generali will write a policy 18 months in advance, but maintains the right to review and revise the policy if there is a change in launch vehicle or satellite status. The firm will also grant coverage 12 months in advance, "but the wording says that the client must inform us of a change in the risk." ³⁵

At least one company, RCA, chose not to insure the launch of its communications satellite (Satcom K-2, in November 1985), rather than pay exorbitant rates, essentially self-insuring the launch.³⁶ Other companies have bought partial coverage and self-insured the remainder. Some insurance companies are encouraging self-insurance in order to rebuild market confidence. These actions are typical of a "hard" market strategy.

THIRD PARTY LIABILITY

The need for third party liability insurance is based on both financial responsibility requirements consistent with the U.S. tort liability law and international treaty liability requirements. The 1967 Outer Space Treaty ³⁷ and the 1972 Liability Convention ³⁸ require that a launching country, in this case the United States, be liable for any damages caused by an object that is launched from that country. Thus, when either the Federal Government or a commercial company launches a vehicle from U.S. property, the U.S. Government is ultimately responsible for any damage to another country's property which results from that launch.

NASA LAUNCHES

When NASA launched commercial U.S. satellites on the shuttle, it required that the customer buy the maximum amount of third party liability insurance available on the world market. Prior to the Challenger accident, that amount was \$500 million for a single payload, and a maximum of \$750 million when multiple payloads were launched during one shuttle flight. The launch customer's third party liability coverage included the Government as a named insured at no cost to the

Government. In return, NASA indemnified the user for any damages above the insured amount (\$500 or \$750 million). Section 308 of the National Aeronautics and Space Act, added to the act in 1979, gives the NASA Administrator the authority to indemnify for third party damages above the amount of insurance.

Once the shuttle is back in operation, NASA plans to continue to launch some private sector and foreign payloads (see footnote 3). According to the NASA General Counsel's Office,³⁹ NASA has in the past defined third party liability insurance requirements based on whether it is a primary payload and whether it rides in the payload bay or in the mid-deck of the shuttle. Customers with primary payloads (meaning they are part of the shuttle's primary mission on that flight) which are paid for in a full reimbursement agreement have been required to buy the full amount of third party liability insurance on the market. That policy is expected to continue in the future. A secondary payload which rides in the mid-deck is generally not required to have third party liability insurance, because it is considered a smaller and safer payload. Secondary payloads carried in the shuttle's payload bay, however, are treated like reimbursable payloads and must be covered by third party liability insurance. A question which remains to be resolved, however, is whether insurance requirements could be waived a part of a Joint Endeavor Agreement with NASA, an agreement through which NASA provides free shuttle flights to encourage the commercial development of space.

COMMERCIAL LAUNCHES

U.S. private launch companies now must purchase third party liability insurance, based on requirements set by DOT. The launch companies are liable for any damages which exceed insurance coverage. The commercial launch companies argue that, although the risk of a catastrophic accident is small, one such accident could wipe out their company and thus they would be "betting the company" with each commercial launch.

In January 1988, DOT issued the first commercial launch license to Conatec, a company which will launch a sounding rocket from the White Sands Missile Range in New Mexico. DOT set insurance coverage limits for Conatec's first launch. Because a sounding rocket is a much smaller vehicle than a launch vehicle placing a satellite into geostationary orbit (the payload does not go into orbit at all), Conatec's insurance requirements are relatively low. Conatec will have to provide \$10 million of third party liability insurance and \$7 million of insurance against damage to Government property. Conatec has arranged to purchase \$20 million, \$3 million above the required amount, based on its own analysis of the risk of liability. Conatec would be liable for any damages in excess of the insured amount.

DOT will examine each license application and determine the amount of risk to the public associated with each launch, establishing insurance requirements. This process is useful for companies with small launch vehicles like Conatec, but may not be for the larger companies.

Representatives from DOT have stated that they expect to find lower levels of damage risk than generally expected,⁴⁰ presumably lower than \$500 million in third party liability for most payloads and launches. However, given the status quo and no cap on liability, if DOT sets a low insurance requirement, the large launch companies will undoubtedly buy above that (as did Conatec), purchasing as much as they find cost effective, to protect their assets in the event of losses above DOT defined risk.

However, if the legislation currently before the Congress goes into effect (H.R. 4399/S. 2395), DOT would be responsible for setting a limit on third party liability, and might set liability at the proposed legislative limit of \$500 million for the large launch companies in order to reduce possible Government exposure to risk.

Availability of Third Party Insurance

The volatility of premiums even in the absence of losses suggests that any third party liability claim could send premiums exorbitantly high. According to a representative of the insurance industry, "It is going to be extremely difficult, if not impossible, to entice casualty underwriters to enter this business with any degree of enthusiasm."⁴¹ Another industry representative, however, states that current capacity is very high, up to \$1 billion.⁴² Congress and the Administration may also need to consider to what extent the Government finds it desirable to support the launch industry if third party liability insurance becomes priced out of reach. With or without adoption of the pending legislation, the DOT will set the level of third party insurance that a company will need in order to get a license for the launch. If, however, the third party liability insurance is "navailable, the commercial companies could be grounded. In addition, if insurance is unavailable to cover the satellite and its launch, only those companies which can self-insure will be able to launch, limiting the demand for launch services. At this point, the launch services industry would undoubtedly ask the Government for assistance, such as providing insurance or setting much lower liability limits, to allow the U.S. launch services industry to survive.

GOVERNMENT RESPONSIBILITY IN AN ACCIDENT

The Federal Government will be involved at different phases of any commercial launch. DOT reviews the plans for each launch, sets the insurance requirements, and licenses the launch. The Air Force will be involved in production standards. Air Force personnel will conduct range services, including safety. Government involvement should effectively increase the confidence of the insurance industry in the reliability of the launch, which in turn may increase insurance market capacity at lower premiums.

Some would also argue that because the Federal Government is evaluating the degree of risk in each launch, setting the insurance requirements, and controlling range safety, including the final go-ahead for each launch, that it should also accept some of the risk and provide indemnification above the insurance requirements. Others contend that

such Government indemnification would be unwise, setting an unwanted precedent for Government interference in other sectors of the insurance industry.

Even without Government indemnification, Government involvement in commercial launch activities also raises the possibility that the Government could be found liable in the event of a launch failure. In the event of a catastrophic accident, a domestic third party could sue both the commercial launch company and the Federal Government for damages. The question of Government liability would have to be resolved in the courts based on the Federal Tort Claims Act.⁴³ In the event of an international third party liability claim of any amount, the U.S. Government would be liable under international law, and has reserved the right to ask for contributions from the launch company.

JOINT AND SEVERAL LIABILITY

With all of the discussion about third party liability resulting from a catastrophic accident, some of the subcontractors and companies and organizations that might place payloads on commercial ELVs have expressed concern that they might also be sued. In the event of an accident, under a legal precept called joint and several liability, any party that is sued could be liable for all of the judgment, even if the party is only partially responsible for the accident. Therefore, joint and several liability is one area of tort law which manufacturers and insurers would like to change. Because insurance is regulated on the State level, reform on this issue is occurring in many States.⁴⁴

DAMAGE TO GOVERNMENT PROPERTY

As with third party liability, the issue is whether the Government should intervene to set a cap and/or indemnify above specified limits for damages incurred to Government property during a commercial launch. Government property, including launch pads, have been damaged in the past. The most recent example was the April 1986 Titan 34D failure that caused \$58.1 million in damages.⁴⁵

The administration has proposed that DOT determine the level of insurance required against damage to Government property. The legislation before Congress (H.R. 4399/S. 2395) proposes the same, but stipulates that the required level cannot be above \$100 million. DOT has expressed concern that \$100 million might not be enough to cover probable damages resulting from a commercial launch. However, the executive branch concurs with the proposed legislation that the Government will not collect damages above the amount of insurance. The legislation sets forth a cross waiver agreement between the launch participants and the Government for damages in excess of insurance. The Government has, in effect, agreed to self-insure above specified insurance levels. In addition, it is the administration's position, and that of the proposed legislation, that under the insured amount, the Government would not collect for "damages caused by Government willful misconduct or reckless disregard." ⁴⁶

CROSS WAIVERS OF LIABILITY BETWEEN COMMERCIAL LAUNCH PARTICIPANTS

As stated previously, NASA provided a cross waiver between shuttle users and NASA in which they agreed not to sue any other participants for damage caused by another participant on the same shuttle flight. Legislation (H.R. 4399 and S. 2395) before Congress would require that the commercial launch services company enter into cross waivers with its contractors, subcontractors, and customers, who would also enter into cross waivers with each other. This cross waiver includes all activities conducted by the private sector companies involved in the launch. Even without such legislation, the launch companies can enter into cross waivers with their subcontractors and customers independently through the contracts they enter into with each other in preparation for the launch. Some insurance companies argue that the legislation would provide a uniform approach for all launch companies, the newer ones in particular.

COMPETITIVENESS WITH FOREIGN LAUNCHERS⁴⁷

The U.S. launch companies argue that they are at a disadvantage with foreign launch companies because the foreign governments provide at least a portion of their third-party liability coverage. This raises the question of whether limiting liability is sufficient to make U.S. commercial launch services companies competitive with foreign launchers. If not, Congress and the executive branch will have to decide whether to provide further support or subsidy to ensure competitiveness. The larger policy questions thus are what level of Government support and involvement is necessary and appropriate and how important the commercial launch services industry is to the country.

The intensity of world competition for the launch services market will depend in part on the level of demand for launch services. Initially, the backlog of payloads resulting from the shuttle accident will mean a larger demand for services. Once the backlog is met, however, the number of commercial launches per year could be as low as 10 to 15 each year, based on past demand. A recent Department of Commerce report predicted that U.S. commercial and foreign demand for launches will total 15 to 25 launches a year over the next ten years.⁴⁸ The size of this market will determine how many different launchers are needed. Demand may only support two or three launchers worldwide, possibly only one or two U.S. companies. A small market will intensify competition among the launch services providers already in the market and result in significant pressure to lower launch prices. A small market could also dissuade new entrants into the market, such as Japan. Obviously, U.S. companies are hoping that a larger market for their own services will develop.

ARIANESPACE

Arianespace, the French launch services company, currently offers the greatest competition to the U.S. launch companies. The ESA, led by

France, developed the Ariane launch vehicle in order to have a launch capability independent from the United States. The launch vehicle is now operated by a company which includes the French space agency (CNES) as a one-third owner. Before and after the shuttle accident, a number of U.S. commercial companies booked launches with Arianespace. Arianespace has orders to launch 43 satellites through 1991. As noted earlier, an Ariane vehicle failed in May 1986, grounding the system for a year and a half. Arianespace has since launched four times, and each was successful.

Since the creation of Arianespace, some observers have argued that the French Government has been "subsidizing" Arianespace. The issue has been a difficult one to resolve, both in terms of CNES's role in the development of the Ariane vehicles and its partial ownership of Arianespace. In 1985, a U.S. private launch company, Transpace Carriers Inc.,⁴⁹ charged Arianespace with unfair pricing practices. After a review by the U.S. Trade Representative, President Reagan found that Arianespace's practices were not unreasonable or sufficiently different from U.S. practices supporting the shuttle which, at that time, was also competing in the world launch services market.⁵⁰ ESA and the United States continue to discuss possible fair trade rules in the international launch services market. One area of concern among U.S. launch companies is third party liability insurance.

In the insurance area, Arianespace has one clear advantage in that the French Government provides third-party liability coverage for any claims over 400 million French francs (about \$70 million). Doug Heydon, President of Arianespace's U.S. office, calls the cap "risk-sharing by the public and private sectors." He points out that it is not a subsidy because no money will be spent unless there is a catastrophic accident, which has never occurred. He also states that the level of the cap was based on NASA's requirement in the 1970s for \$100 million in third party liability insurance. At the time, \$100 million converted to 400 million French francs.⁵¹

SOVIET UNION

The Soviet Union has been actively marketing its launch services in the West. As part of its marketing, the Soviet Union has offered to provide launch insurance. The Soviets have been willing to price launches below cost in order to attract foreign currency. However, the United States restricts the export of sensitive technology to the Soviet Union, and thus satellites with U.S. components cannot be exported to the Soviet Union for launch. Currently, all non-Soviet bloc communications satellites contain some U.S. components. Thus far, no country has challenged the U.S. restrictions on using Soviet launch services.

CHINA

The People's Republic of China is marketing its Long March-2 (CZ-2) and Long March-3 (CZ-3) launch vehicles. China has launched three relatively small domestic communications satellites into geostationary orbit since 1984. China has said that it will underprice its launches

in order to make its services more attractive and China's state-owned People's Insurance Co. will offer any necessary insurance.⁵²

The United States does not explicitly prohibit the export of satellites to China. A U.S. company can apply for an export license, which will be considered on a case-by-case basis. Despite press reports of U.S. companies interested in launching with China, thus far, no company has gone through the export procedure. U.S. companies may want to wait until China has had more launch experience before buying launch services from them. Sweden has signed a contract with China for the launch of a small scientific satellite, Freja, and French and German companies are using Chinese services for materials processing experiments. All of these use the Long March-2 for reaching low Earth orbit.

JAPAN

Japan also has a launch capability and its major launch vehicle (the "N" vehicle) is based on U.S. technology. Through a 1969 bilateral agreement, Japan has access to U.S. launch technology, but is prohibited from launching satellites for other countries without the consent of the United States. Japan is developing a new launch vehicle, the H-2 vehicle, which will not use U.S. technology, and, if the Japanese so choose, they could market launch services on that vehicle. Japan's launch capability is also currently constrained by an agreement with its own fishermen limiting launches to no more than twice a year from each of its two launch sites for environmental reasons.⁵³ Japan could either try to modify this agreement or build a new launch site, possibly elsewhere in the Pacific, if it decided to enter the launch services market. The H-2 vehicle will be operational after 1992, at which time the commercial potential of the world launch services market may be better understood.

OPTIONS

In the long run, a series of successful launches is the best way of increasing underwriter confidence and expanded insurance capacity in the space insurance market. U.S. commercial space launch companies are, however, seeking a more short term insurance solution. Considerations of whether U.S. launch services companies are facing extreme price and supply problems and whether the Federal Government should intercede involve several criteria.

First, if a catastrophic accident occurred and third party damage exceeded \$500 million, the question is whether there would be a viable commercial launch industry. The status of the launch industry after a major accident might depend more on timing than on a liability cap or Government indemnification. Possibly the worst case scenario is a catastrophic accident during one of the first commercial launches, which could cause public pressure on the Government to stop all launches, at least in the short term. In that case, the level of Government support, including indemnification, would probably make little difference and it would be more difficult to argue for further Government support. At that point some might argue for complete Government control of

launch vehicles. However, if it did not occur for many years, Government support might have paid off in firmly establishing the potential capability and viability of the launch services industry. Or the time elapsed might have allowed an option, such as an industry-support self-insurance fund, to have gathered moneys toward paying off the liability or for the space insurance industry to have strengthened. Ultimately, given the volatile nature of the space insurance industry, an accident at any time which caused massive third party damages would shake the foundations of both Government and commercial launches of any kind.

Another question is whether a liability cap and Government indemnification for excess third party liability would guarantee the competitiveness of the commercial launch services industry. The U.S. commercial launch industry argues that it faces strong competition from other countries with Government backing. Former NASA Administrator James Beggs stated that he does not expect the U.S. launch companies to survive international competition for what he believes will be a relatively small market.⁵⁴ If the Congress and Administration strongly believe in the importance of this industry, they may want to consider what further measures of Government support, if any, they would be willing to back.

As stated previously, space insurance premiums have risen primarily as a result of a lack of confidence in the industry; with experience and renewed confidence, premiums could drop considerably and insurance capacity could increase. Government indemnification is one way of encouraging confidence. Government involvement in different phases of the launch process, including overseeing launch vehicle production and range safety, should also increase market confidence.

Several options, with their advantages and disadvantages, are discussed below.

LET THE MARKET OPERATE FREELY *

One alternative is to do nothing and assume that the launch vehicles will demonstrate their previous records of successful launching and that the insurance market will provide adequate coverage. According to some in the insurance industry,⁵⁵ the market can provide \$1 billion to cover third party liability. Most industry members believe that a catastrophic accident is unlikely and that range safety precautions make the chances of hitting populated areas so remote that \$500 million to \$1 billion third party liability insurance coverage ought to be adequate. One could argue that if a catastrophic accident occurs, a Government cap and indemnification will not save the U.S. commercial launch industry. It might save that one company great financial losses, but that company could try to name the Government as a liability partly because of its involvement in the launch failure.

The administration argues that they see no reason to single out this one industry to help with its insurance problems.

Last July, the Commercial Space Working Group of the Economic Policy Council declined to support the industry's request for in-

demnification. The group concluded that this sort of extraordinary remedy could not be justified for the launch industry.⁵⁶

Some have also argued that Government interference in the insurance market would "hurt space insurers that would have little chance to recoup past losses."⁵⁷ Insurers would not be able to sell insurance above the liability limit set by the Federal Government, because no one would buy it.

FEDERAL GOVERNMENT LIABILITY LIMITS AND INDEMNIFICATION OF EXCESS THIRD PARTY LIABILITY

Even though most observers agree that the probability of a catastrophic accident is remote, the launch services companies argue that they do not want to "bet the company" with each launch. An American Institute for Aeronautics and Astronautics (AIAA) study recommended that the industry be held responsible for the maximum probable risk (to be determined by the Government), while the Government takes on the more remote, maximum possible risk.⁵⁸ This recommendation is similar to the conditions set forth in legislation (H.R. 4399 and S. 2395) before the Congress, which would give the Department of Transportation the authority to determine the level of third party liability insurance available on the world market at "a reasonable price," not to exceed \$500 million.

In addition to capping the amount of liability, the legislation proposes that the Federal Government indemnify, or pay for, damages which exceed the cap. Those in favor of this solution argue that the Government would have to bear a very small risk of a catastrophic accident. Indemnification would also allow a third party to recover the full amount of damages awarded in a court. They argue that a cap by itself prohibits total protection, or the right to sue for all-inclusive damages.

The administration proposes placing a limit of \$200,000 on non-economic damages to third parties, such as pain and suffering. This proposal is considered very controversial because it involves limiting potential tort recovery and amounts, in effect, to tort "reform." The Administration is opposed to indemnification of third party liability which it views as a direct subsidy. As stated above, DOT has testified that it sees no need to single this industry out for special protection.

RISK POOLING THIRD PARTY LIABILITY

The Price-Anderson Act (enacted as P.L. 85-256 in 1957), which covers nuclear power plants, is often cited as an example of the Federal Government's willingness to limit liability and indemnify a newly emerging industry in order to encourage its development. It is also an example of risk pooling, which is where its relevance to launch services becomes less clear. Price-Anderson was set up so that once private insurance plus the contributions to an insurance pool exceeded a certain limit, the Government no longer was required to indemnify.

The Price-Anderson Act is an excess coverage indemnity statute,⁵⁹ meaning that the Federal Government would take on risk only after the individual company's insurance and insurance provided through con-

tributions by each nuclear company to a pool had been exhausted. Currently, the various levels of coverage equal \$720 million, well above the initial limit on liability, \$560 million, so that Federal indemnification is no longer required. (Insurance coverage could increase to \$7 billion in the next few years.) There are now 112 nuclear plants online and no one has collected for third party damages, both of which have allowed the pool to increase.⁶⁰

The U.S. launch services industry consists of only three large companies and several small companies, and the latter would probably be limited in their capability to contribute to a self-insurance pool. Three companies are undoubtedly insufficient to create a pool over the short term, the time period during which the guarantee of third party coverage is needed. Another possibility is that all of the subcontractors participating in the launch industry could contribute to the pool. The subcontractors would, however, pass the cost of contributing to a pool along to the launch company. Imposition of payment into a pool could increase costs and make the companies less competitive.

Arguments in favor of pooling third party liability risk include: (1) contributions to a pool would give the launch companies further incentive to increase reliability and to lower their operating costs, and (2) creation of a pool would relieve the Government of the burden to pay for catastrophic losses. If the risk of a catastrophic accident really is very low, the pool would build up over time and provide real coverage in the long term.

TIERED INSURANCE AND GOVERNMENT INSURANCE⁶¹

This proposal does not create a pool, but simply would partially reimburse the Government for increased third party liability coverage or indemnification.

Briefly stated, the space launch industry's concern is that they will buy the amount of third party liability insurance available on the market but still run the risk of being sued for amounts above that. Under the tiered insurance proposal, the private launch company would buy the amount of insurance available on the market (at reasonable prices), which would be the first tier of insurance. The Government could establish a third party liability fund to insure for some amount above that and charge premiums, providing the second tier.

A study would have to be performed to determine how much additional insurance the Government would provide or whether the Government would cover all risk above available insurance coverage. Another issue for study would be what premium the Government would charge. The premium would have to be high enough in order to avoid undercutting any possible commercial insurance business. Industry would have to determine if it really requires full third party liability coverage or if it needed coverage to \$1 billion to feel secure in its business (or possibly \$500 million). The Government would also have to reassess its arguments that the risk of catastrophic failure is so low as to not be a threat, because they would be insuring against that possibility and setting the premium. As a benefit, the Government

would be taking revenue into the fund, until the event of an accident. After a string of successful launches, the private sector might stop buying the second tier of insurance.

The disadvantages to this proposal are that it requires additional revenue from the commercial launch companies which could increase launch prices, making it less competitive with foreign companies. In addition, unless the Government provided limitless coverage, this proposal would not provide the security of indemnification.

CONCLUSION

The U.S. commercial launch services companies want a solution that will allow them to launch in the near term. They argue that the Government should place a limit on third party liability and liability for damage to Government property and indemnify above those levels. According to the industry, these measures would allow them to launch without "betting the company" and to price their launches competitively with foreign launchers. The administration and others disagree, arguing that it would set an unwanted precedent for Government interference in other sectors of the insurance industry.

It is not a question of whether the Government should support the commercial launch industry, because, as discussed previously, the Government is involved in many ways, from leasing facilities and services, to providing components. It is a question of how much Government involvement is appropriate. The answer to that question ultimately lies in larger policy questions.

Although one can examine the importance of the commercial launch services industry, the competitiveness of foreign launchers, and the state of the insurance industry, there is no way to know if the commercial launch industry could survive on its own, without any assistance. Conversely, there is no way to predict if the industry might ultimately fail in the face of international competition and low demand despite limits on liability and Government indemnification. The immense risks that commercial space endeavors, including the launch services industry, face inevitably have led private launch companies to ask the Government to share that risk. Congress and the executive branch face the task of re-examining the Nation's goals and priorities to decide what level of Government involvement is desirable.

Congress and the executive branch will have to continue to face policy decisions as both the Government and private sector continue to venture into space. All business conducted in space will first involve a launch and that launch will have to be insured. When the United States begins building and operating the space station new issues, including insurance, undoubtedly will arise. The interaction of Government and private facilities, personnel, and space transportation vehicles will create more complex liability questions in the future. The insurance industry will be willing to get involved only if it has confidence in the technology and expects to make a profit, two elements which may not always be present in the commercial development of space.

ENDNOTES

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